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(E76-10062) ICE INVESTIGATIONS USING
LANDSAT-2 IMAGERY Quarterly Report
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First quarterly report
of ice investigations using LANDSAT-2 imagery.
By Erkki Palosuo

Supplement
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In March 1975 Finnish-Swedish project of wide spread ice
research was arranged to find the best method of using LANDSAT-2
in winternavigation.

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The recognition of ice situation was made using different kind
of methods: air photography IR-scanner, SLAR-, FLAR-systems etc.
A list of these arrangements is included.

Three sets of LANDSAT-2 coverage were received:

March 14	E-2051-09101	N65-33 E025-50
" 15	E-2052-09155	N65-31 E024-23
" 16	E-2053-09214	N65-34 E023-01

These pictures have been analyzed and comparison of results with
other methods is going on. A complete report will be ready in a
few months.

To study the deformation of an ice field the following LANDSAT-2
pictures were also analyzed:

April 2	E-2070-09155	N65-37 E024-18
"	E-2070-09161	N64-16 E022-56

At the time the ice field was already broken and was drifting.
The floes were clearly seen in the pictures and therefore easy to
recognize.

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SUMMARY OF REGISTRATIONS MADE DURING "SEA ICE -75"

	10/3	11/3	12/3	13/3	14/3	15/3	16/3	17/3	18/3	19/3	20/3	21/3
	Day 0 Day 1 Day 2 Day 3 Day 4											
SR (NOAA 4)	X	X	X	X	X	X	X	X	X	X	X	X
VHRR (NOAA 4)	X	X	X	X	X	X	X	X	X	X	X	X
MSS (Landsat 2)					X	X	X					
High altitude camera	X		X		X			X				
Wild camera					X			X				
MS-camera				X					X			
IR-Scanner									X	X	X	X
IR-radiometer										X	X	
SLAR			(X)	X	X				X	X		X
FLAR		(X)	(X)	X	X			(X)	X	X	X	
ODAR									X	X		
Ships radar		X	X			X	X	X				
Radar altimeter		(X)			X	X	X					
Microwave radiometer								(X)	X	X	X	
Under water camera	X			X	X		X	X	X		X	
Under water TV	X					X					X	
Sonar							X	X				
Meteorological parameters	X	X	X	X	X	X	X	X	X	X	X	X
Oceanographic parameters	X	X	X	X	X	X	X	X	X	X	X	X
Ice parameters Swedish area	X	X	X	X	X	X	X	X	X	X		
Ice parameters Finnish area												

(X) indicates preliminary tests

X indicates successful registrations

<u>Sensor</u>	<u>Date</u>	<u>Time</u>	<u>Scale</u>	<u>Altitude</u>	<u>Cloud_%</u>	<u>Covered_area</u>
<u>Optical and IR-sensors</u>						
<u>Satellites</u>						
SR (NOAA-4) (Vis+IR)	10	0921		1473 km	10-20	Bay of Bothnia
"	11	0822		"	70	"
"	12	0917		"	10-20	"
"	13	0817		"	20	"
"	"	1012		"	70	"
"	14	0918		"	10	"
"	15	0811		"	60	"
"	16	0907		"	50-60	"
"	17	0807		"	0	"
"	"	1001		"	0	"
"	18	0902		"	10-20	"
"	19	0802		"	0	"
"	"	0957		"	0	"
"	20	0957		"	80	"
"	"	1050		"	50-60	"
VHRR (NOAA 4)	Cf SR (NOAA 4)					
MSS (Landsat 2)	15/3 or					
	16/3 or					
	17/3					
<u>Aeroplanes</u>						
High altitude camera	10/3	1330	1:200.000	11.600 m	0	Luleå → Malören → TOR → KF 0310 → Rödkallen → Luleå Covers Finnish and Swedish 15x15 km areas

	<u>Date</u>	<u>Time</u>	<u>Scale</u>	<u>Altitude</u>	<u>Cloud %</u>	<u>Covered area</u>
High altitude camera	10/3	1330	1:52.000	11.600 m	0	Luleå → Malören → TOR Covers great parts of the Swedish 5x5 km area
"	"	1330	1:5.000	"	0	Track over TOR direction 160° Width 1.5 km, Length 19 km, Covers half of the Swedish 1x1 km area
"	12/3	1100	1:160.000	9.000 m	0	Track from Malören direction 200° Width 18 km, Length 47 km, Covers half of the Swedish 15x15 km area
"	"	1100	1:15.000	"	0	Three tracks over unidenti- fied areas
"	17/3	0930	1:200.000	11.600 m	0	Luleå → Malören → south- wards → (TOR in a corner), Luleå → southwards Parts difficult to identify. Covers half of the Swedish 15x15 km area
Wild camera	14/3	14.30-15.10	1:30.000	4.600 m	0	Swedish 15x15 km area
"	17/3	14.20-15.40	1:30.000	4.600 m	0	Swedish 15x15 km area
MS-camera	13/3	11.40-12.30	1:15.000 1:30.000	1.500 m	0	Swedish 5x5 km area
"	18/3	11.20-12.10	1:15.000 1:30.000	1.500 m		Swedish 5x5 km area

	<u>Date</u>	<u>Time</u>	<u>Scale</u>	<u>Altitude</u>	<u>Cloud %</u>	<u>Covered area</u>
IR-scanner (GeHg-detector)	19/3	11.45-12.30		300 m 500 m		Swedish 5x5 km area (50% of the area)
"	"	12.30-13		500 m		Swedish 5x5 km area (90% of the area)
IR-scanner (MCT-detector)	"	15 - 16		2.000 m		Swedish 5x5 km area
"	"	16.00-16.15		2.000 m		Part of the distance Malören → Bjuröklubb
IR-radiometer	19/3	8 -	-			Swedish 1x1 km area
"	"		-			IR-band within the Swedish 5x5 km area
"	"		-			Track Tor → eastnortheast km
"	20/3	7 -	-			Swedish 1x1 km area
"	"		-			IR-band within the Swedish 5x5 km area
"	"		-			Track Tor → eastnortheast km.
<u>Microwave sensors</u>						
SLAR	12/3	14.50-15.50	1:100.000	300 m		Swedish 15x15 km area. Preliminary tests
"	13/3	13.15-14.10	1:100.000 (1:200.000)	300 m		Swedish 15x15 km area

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	<u>Date</u>	<u>Time</u>	<u>Scale</u>	<u>Altitude</u>	<u>Cloud %</u>	<u>Covered area</u>
SLAR	14/3	11.00-13.00	1:100.000 (1:50.000)	400 m (70)		Luleå → Malören → Bjuröklubb → eastsoutheast to the Finnish coast → north to Malören → Luleå. Band width 2x6, 3 km
"	18/3	11.05-11.50	1:100.000	300 m		Swedish 15x15 km area
"	18/3	12.10-13.20	1:200.000	7.000 m		Malören → Bjuröklubb east to the Finnish coast → north to Malören covering Finnish and Swedish 15x15 km areas → Luleå. Band width 1x25 km
"	19/3	13.20-15.10	1:100.000	170 m 300 m		Finnish and Swedish 15x15 km area
FLAR	11/3	15-16		450 m		Swedish 15x15 km area. Preliminary tests
"	12/3	14.30-16		100 m 450 m		Swedish 15x15 km area. Preliminary tests
"	13/3	13.15-14.30		100 m 250 m 450 m		Swedish 15x15 km area
"	14/3	10.45-13.00		50 m 450 m		Same as the SLAR 14/3
"	17/3	13.15-14.15		100 m 250 m		Swedish 15x15 km area Preliminary tests
"	18/3	11.00-13.30		100 m 450 m		Same as the SLAR 13/3

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	<u>Date</u>	<u>Time</u>	<u>Scale</u>	<u>Altitude</u>	<u>Cloud %</u>	<u>Covered area</u>
FLAR	19/3	13.30-15.45		100 m 450 m		Finnish and Swedish 15x15 km areas
"	21/3	12.30-13.25		1.800 m		Malören - Bjuröklubb Holmön
ODAR	18/3	10.00-11.30	1:100.000 1:200.000	100 m 200 m 300 m 500 m		Swedish 15x15 km area
"	19/3	10.00-11.15	1:100.000 1:200.000	30 m 170 m 300 m 700 m		Swedish 5x5 km and 15x15 km areas
"	19/3	13.10-14.30	1:50.000 1:1.000.000	30 m 170 m 1.000 m 1.700 m		Swedish 1x1 km area. The northern parts of the Bay of Bothnia
"	20/3	09.20-10.20	1:200.000 1:1.000.000	700 m		The northern parts of the Bay of Bothnia
Ships radar (3 cm)	12/3	17.00	1:1.000 1:5.000	25 m		Covers a circular area around TOR
"	15/3	17.15	1:1.000	"		"
"	16/3	20.30	1:1.000 1:1.5.000	"		"
"	17/3	16.00	1:1.000 1:5.000	"		"
"	19/3	18.50	1:1.000 1:5.000	"		"

	<u>Date</u>	<u>Time</u>	<u>Scale</u>	<u>Altitude</u>	<u>Cloud %</u>	<u>Covered area</u>
Ships radar (10 cm)	11/3	07.00	1:1.000 1:5.000	25 m		Covers a circular area around TOR
"	12/3	17.20	1:10.000	"		"
"	15/3	17.30	1:5.000 1:10.000	"		"
"	16/3	20.50	1:5.000 1:10.000	"		"
"	17/3	16.20	1:10.000	"		"
"	19/3	19.00	1:5.000 1:10.000	"		"
Radar altimeter	11/3	13-14	-	2-30 m		Luleå → TOR. Preliminary tests
"	14/3	10-11	-	4-10 m		Swedish 1x1 km area
"	15/3	10-11	-	4-10 m		Swedish 5x5 km area
"	16/3	14-15	-	4-10 m		Swedish 5x5 km area
Microwave radiometer	17/3					Preliminary tests
"	18/3			25 m 50 m		Swedish 5x5 km area (lines A, B, C, D, E and F)
"	19/3			25 m 50 m		Swedish 5x5 km area (lines A, B, C, D, E and F)
"	19/3			25 m		Test track within the Swedish area identical with the track followed by the IR-scanner.

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	<u>Date</u>	<u>Time</u>	<u>Scale</u>	<u>Altitude</u>	<u>Cloud %</u>	<u>Covered area</u>
Microwave radiometer	19/3			50 m 100 m		Test track via TOR along a green Decca line J42 between the red lines F3 and E15 (TOR: Green J42, 0 and Red E17, 75)
"	20/3			20 m 40 m 80 m		Isolated, important ice ridge (Decca readings: Green A33, Red E24)
<u>Underwater sensors</u>						
Underwater camera	10/3 13/3 14/3 16/3 17/3 18/3 20/3					
Underwater TV	10/3 15/3 20/3					
Sonar	16/3 17/3 18/3					
<u>Ground truth</u>						
Meteorological parameters						Around TOR
Wind	10-20/3	Every 15 min				"
Temperature	"	"	and continuously			"
Air pressure	"	"	"			"
Humidity	"	Every 3 hours				"

	<u>Date</u>	<u>Time</u>	<u>Scale</u>	<u>Altitude</u>	<u>Cloud %</u>	<u>Covered area</u>
Visibility	10-20/3	Every 3 hours				Around TOR
Clouds	"	"	"			"
Weather	"	"	"			"
Oceanographic parameters						
Current	10-20/3	Continuously + occasionally				Around TOR
Watertemp.	"	Occasionally				"
Salinity	"	"				"
Ice parameters (Swedish area)						
Concentration	10-19/3	Regularly				Northern Bay of Bothnia
Thickness	"	"				1x1, 5x5 and 15x15 km areas
Pressure ridges (height-width)	"	"				"
Roughness	"	"				"
Snow cover	"	"				"
Ice-open water	"					Northern Bay of Bothnia
Floes size	"					1x1, 5x5 and 15x15 km areas
Ice drift	10-20/3	Every 15 min				Position of TOR
Ice deformation	"	"				5x5 and 15x15 km areas
Ice temperature	10-19/3	Continuously				Around TOR
Ice salinity	19/3					"